PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION	See Form PCT/IPEA/416
BW331R/RML		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2004/051106	14.06.2004	12.06.2003

International Patent Classification (IPC) or national classification and IPC
B32B17/10

Applicant
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1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 7 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 4 sheets, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
11.04.2005	13.05.2005

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INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2004/051106

Box No. I Basis of the report

1. With regard to the **language**, this report is based on the international application in the language in which it was filed, unless otherwise indicated under this item.

   ☐ This report is based on translations from the original language into the following language , which is the language of a translation furnished for the purposes of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4)
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3)

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-3, 5-8	as originally filed
4	received on 12.04.2005 with letter of 11.04.2005

Claims, Numbers

1-15	received on 12.04.2005 with letter of 11.04.2005

Drawings, Sheets

1/5-5/5	as originally filed

☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing

3. ☐ The amendments have resulted in the cancellation of:
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).
   - ☐ the description, pages
   - ☐ the claims, Nos.
   - ☐ the drawings, sheets/figs
   - ☐ the sequence listing *(specify)*:
   - ☐ any table(s) related to sequence listing *(specify)*:

* *If item 4 applies, some or all of these sheets may be marked "superseded."*

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-15
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-15
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-15
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V.

1 The following documents are referred to in this report:
D1: WO 91 19586 A (MONSANTO CO) 26 December 1991 (1991-12-26)
D2: US-A-5 264 058 (HOAGLAND JOHN C ET AL) 23 November 1993 (1993-11-23)
D3 : DE 199 02 471 A (SEKURIT SAINT GOBAIN DEUTSCH) 3 August 2000 (2000-08-03)
D4 : US 5 209 881 A (CHARBONNET DERRICK) 11 May 1993 (1993-05-11)

2. The international application concerns a process for the manufacture of laminated safety glass wherein in a first step a functional intermediate layer is pretensioned and then thermoformed on a mould to conform to the curvature of the final glazing. This process further comprises a step of cooling "by forced draught" the shaped biaxially oriented thermoplastic functional layer to fix the shape of the functional layer before finally positioning the pre-laminate between two glass panes and subjecting the whole assembly to autoclaving (claim 1 - combined subject-matter of originally filed claims 1 and 2).

Article 33(2) and (3) PCT

3.1 D1 discloses a method as to how to shape a composite interlayer to conform to the shape of the glazing to be manufactured.

According to method claim 10 of D1, which is more concrete than claim 1 of D1, the process for forming a shaped laminate for use in a safety glazing such as a vehicle window comprises:

a) encapsulating a flexible, transparent, carrier layer of biaxially orientated polyethylene terephthalate having a multi layer solar radiation control or electrically conductive stack on its surface within layers of plasticized polyvinyl butyral to form a premolding composite;
b) heating the premolding composite to shaping temperature;
c) stretching the heated composite against the surface of a shaping mold to impart

compound curvature thereto and form a shaped, shrinkable laminate;
d) heating the shaped, shrinkable laminate to a temperature above the shaping temperature while containing its edges to relieve stresses in the laminate developed during step c); and
e) cooling the stress-relieved, shaped laminate while maintaining its edges constrained.

The pre-laminate comprises a polyester film coated with functional layers and polyvinyl butyral adhesive layers (Fig.2 and p.12, l.35 to p.13, l.35).

This method lacks the characterizing features of present claim 1, namely the pretensioning by injecting hot air from the bottom of the mould and the forced cooling after relaxation of the thermoformed interlayer.
The composite laminate which is relieved of stresses is allowed to cool down while still being clamped to the mould (p.11, ll.16-20 and p.15, ll.9-13).

It is therefore concluded that claim 1 is novel over D1 (**Article 33(2) PCT**).

3.2 The problem underlying the teaching of D1 is wrinkle formation when forming a curved laminated glazing.
One point of concern is the presence of strain which is imparted to the composite when shaping it to conform with the contour of the mould by using clamps.
For this reason, D1 teaches heating the composite laminate in restrained state at a temperature above 121° C (if poly(ethylene terephthalate) is used as a carrier film) to relieve stresses.
This is expressed in lines 5 to 20 at page 11 and in lines 20 to 36 at page 14.

Injecting hot air to effect pretensioning is not suggested by D1. Instead, it is asserted that the initial film - before shaping - has been released of stresses (p.13, ll.2-25).
Use of pressurized air is mentioned in lines 47 to 52 at column 5 of D2 but not in the context of heating a pre-laminate.
D1 does not suggest that forced cooling should be conducted in order to lock the form of the shaped interlayer, either.
Whereas D1 deals with the same problem of wrinkle formation, it is silent about the

measures which represent the characterizing part of present claim 1 (**Article 33(3) PCT**).

3.3 The subject-matter of the dependent claims does not add features which would differ significantly from the prior state of the art.
This circumstance does however not affect the assessment of novelty and inventive step.

The subject-matter of present dependent claims 2, 10 and 13 is known D1.
Claim 14 is known from lines 6 to 9 at page 15 of D1.

Corrosion of the peripheral part of a metal-containing functional layer such as a low E coating is a well-known phenomenon.
Measures that have been developed in order to counteract corrosion comprise removal of the peripheral part of the interlayer or making an incision in order to electrically separate the peripheral part from the area in the visible part of a safety glazing.

3.4 Conforming an interlayer film corresponding to the final shape of a laminated glazing would be envisaged by a skilled person.
Cold-stamping represents one possible manner which however is not related to the problem of avoiding wrinkle formation after the shaping step in a mould (present claim 4 - cf. column 3, lines 28 to 44 of D3).

Fixing layers of a glass laminate to be formed in a mould by vacuum is a usual measure (present claim 5).

The orientation of the bonding layer towards the (first) glass pane is evident (present claim 6) and the orientation of the functional layer in the final glazing is of no importance for the shaping step (present claim 7).

Use of poly(vinyl butyral) is a bonding resin is conventional (present claim 10).

Present claims 11 and 12 do not specify radii of curvature which would exclude any

radius of practical interest.

3.5 The subject-matter of claim 15 is primarily related to the problem of controlling the temperature of a material in a heating or fusing cycle.

As there is no hint that use of an infrared pyrometer would be crucial for achieving the objects of the invention, this subject-matter is regarded not to represent an essential feature of the invention.

At last, the International Application Publ. No. WO 91/19586 discloses a process wherein a composite interlayer is laminated with all the end layers, thermoformed on a mould and then allowed to cool. Again, the end product is not completely satisfactory.

Thus, from one aspect this invention provides a process for the production of a curved laminated glass pane comprising a first glass sheet and a second corresponding glass sheet, together with an interlayer comprising at least one bioriented thermoplastic functional layer, i.e. pre-stretched according to two directions substantially perpendicular therebetween in order to prevent wrinkling, and a corresponding at least one layer of a bonding resin having a reduced level of optical defects due to creasing of the interlayer, such process comprising the steps of positioning said interlayer between the two glass sheets and applying pressure and heat to form a laminated pane showing an end shape with one or more curvatures, which **process is defined in appended claim 1.**

In a preferred embodiment, the interlayer may comprise one or more functional layers cold-overlapped prior to thermoforming and then thermoformed in a single cycle, by heating to a softening temperature adequate for all the functional layers, depositing on a mould and applying vacuum between mould and interlayer, followed by a final cooling by forced draught.

According to another preferred embodiment, the functional layer comprises a peripheral pre-cut portion apt to be removed from the interlayer. In this embodiment, one bonding resin layer is adhered to one face of said functional layer, the latter being subsequently cold-stamped in a configuration substantially corresponding to the end shape of said curved laminated glass pane, placed a mould and heated and then cooled by forced draught. This thermoforming step allows the thermoplastic functional layer to be permanently shaped after the subsequent cooling by forced draught.

The resulting interlayer is positioned on a glass glazing adhering the bonding resin to the glass surface, and said pre-cut portion is peeled off, whereby the outer edge of the functional layer remains to a certain distance from the edge of the glazings. Then, a

CLAIMS

1. A process for the production of a curved laminated glass pane (1) comprising a first glass sheet and a second corresponding glass sheet (2), together with an interlayer (3; 3') comprising at least one bioriented thermoplastic functional layer (5) and at least one layer of a bonding resin (4), such process comprising the steps of:

* thermoforming on a mould said at least one bioriented thermoplastic functional layer (5), together with at least one layer of a bonding resin (4) adhered to said at least one bioriented thermoplastic functional layer (5), in a configuration substantially corresponding to the end shape of said curved laminated glass pane (1);

* positioning said interlayer (3, 3') between the two glass glazings (2) and applying pressure and heat to form a laminated glazing showing an end shape with one or more curvatures.

characterised in that, before the thermoforming step, said at least one bioriented thermoplastic functional layer (5) and at least one layer of a bonding resin (4) are heated and, during such heating, a hot air jet is injected from the bottom so as to effect a pretensioning of said at least one functional layer (5) and then, after the thermoforming step and before said positioning said interlayer (3, 3') between the two glass glazings (2), said at least one functional layer (5) and said suitable layers of a bonding resin (4) are cooled by forced draught, whereby the shape of said at least one functional film (5) is frozen.

2. A process according to claim 1, wherein said interlayer (3) comprises two bonding resin layers (4), intended to be positioned into contact with distinct glass sheets (2), each adhered to the opposite side of one f functional layer (5).

3. A process according to claim 1, wherein said interlayer (3') comprises one functional layer (5), and a corresponding one bonding resin layer (4), adhered to one face of the functional layer, the functional layer (5) comprising, along its whole edge a pre-cut peripheral portion (5'), apt to be removed in a subsequent step.

4. A process according to claim 1 or 3, wherein, before the thermoforming and the cooling steps, said interlayer (3') is cold-stamped in a configuration substantially corresponding to the end shape of the curved laminated glass pane to be manufactured.

5. A process according to claim 3 or 4, wherein, in the thermoforming step, vacuum is applied to the interlayer (3') to make it adhere to the mould with the functional layer (5) adherent to the mould surface.

6. A process according to one of the claims 3 to 5, wherein, in the positioning step, the shaped interlayer (3') is positioned over one glass glazing (2), with the bonding resin layer (4) is applied to the glass surface.

7. A process according to claim 6, wherein said one glass glazing (2) is intended to be at the internal side of the final glass pane (1).

8. A process according to claim 6 or 7, wherein said pre-cut portion (5') is peeled off when the interlayer (3') has been positioned over said one glass glazing (2), whereby the outer edge of the functional layer (5) remains to a certain distance from the edge of said one glazing (2).

9. A process according to one of the claims 6 to 8, wherein, in the positioning step, a further bonding resin layer (4) is applied at least on the exposed functional layer (5) surface, and a second glass glazing (2) is positioned on it, the shape thereof perfectly matching with the shape of said one glazing (2) and of the interlayer (3') covered by said additional bonding resin layer (4).

10. A process according to any of the preceding claims wherein said bonding resin is polyvinylbutyral (PVB).

11. A process according to any of claims 1 to 3 characterised in that the glass pane is a curved glass pane having a cross curvature of at least 5.0 mm.

12. A process according to any of claims 1 to 3 characterised in that the glass pane is a curved glass pane wherein at least a part of the curved surface has a radius of less than 10000 mm.

13. A process according to any one of the preceding claims wherein said functional layer (4) comprises a film in polyethylene terephthalate (6) with one or more filtering (7) and/or reflecting (8) sub-layers adhered thereto.

14. A process according to any one of the preceding claims wherein in the thermoforming the heating temperature is set at 130°C +/- 30°C.

15. A process according to any one of the preceding claims wherein in the

thermoforming there is employed a temperature detection system with use of an infrared pyrometer (16) with a wavelength sensor which detects the temperature rise of said at least one bioriented thermoplastic functional film (5) and said suitable layers of a bonding resin (4) and, as soon as the temperatures reaches the preset value, activates a system that interrupts the heating.